CLAIMS

We claim:

1   1. A method for early detection of subacute, potentially catastrophic infectious

2   illness in a premature newborn infant comprising:

3   (a) continuously monitoring heart rate variability in the premature newborn infant;

4   and

5   (b) identifying at least one characteristic abnormality in the heart rate variability that

6   is associated with the illness.

1   2. The method of claim 1, wherein the illness is sepsis.

1   3. The method of claim 2, wherein antibiotic therapy is initiated and a diagnostic

2   work-up for the illness, comprising obtaining a blood culture from the newborn

3   infant, is provided when the at least one characteristic abnormality is identified.

1   4. The method of claim 1, wherein the illness is necrotizing enterocolitis.

1   5. The method of claim 4, wherein a diagnostic work-up for the illness, comprising

2   an X-ray of the newborn infant or a pathological specimen from the newborn infant,

3   is provided when the at least one characteristic abnormality is identified.

1   6. The method of claim 1, wherein the illness is selected from the group consisting

2   of pneumonia and meningitis.

1   7. The method of claim 1, wherein the at least one characteristic abnormality is

2   identified from a normalized data set of RR intervals.

1   8. The method of claim 7, wherein the data set contains on the order of about 10^3 to

2   10^4 sequential RR intervals.

1   9. The method of claim 7, wherein the at least one characteristic abnormality is
2   identified based on at least one of the third and higher moments of the data set.

1   10. The method of claim 9, wherein the at least one moment of the data set includes
2   the skewness of the data set.

1   11. The method of claim 10, wherein the illness is selected from the group
2   consisting of sepsis and necrotizing enterocolitis.

1   12. The method of claim 9, wherein the wherein the at least one moment of the data
2   set includes the kurtosis of the data set.

1   13. The method of claim 12, wherein the illness is selected from the group
2   consisting of sepsis and necrotizing enterocolitis.

1   14. The method of claim 7, wherein the at least one characteristic abnormality is
2   identified based on at least one percentile value of the data set.

1   15. The method of claim 14, wherein the at least one percentile value is the 10th
2   percentile value.

1   16. The method of claim 15, wherein the illness is selected from the group
2   consisting of sepsis and necrotizing enterocolitis.

1   17. The method of claim 7, wherein the at least one characteristic abnormality is
2   identified based on the variance, standard deviation or coefficient of variation of the
3   data set.

1   18. The method of claim 17, wherein the illness is selected from the group
2   consisting of sepsis and necrotizing enterocolitis.

1   19. The method of claim 10, further comprising a diagnostic work-up.

1   20. The method of claim 12, further comprising a diagnostic work-up.

1   21. The method of claim 15, further comprising a diagnostic work-up.

1   22. The method of claim 17, further comprising a diagnostic work-up.

1   23. The method of claim 1, wherein a diagnostic work-up is provided when the at
2   least one characteristic abnormality is identified.

1   24. A method for early detection of subacute, potentially catastrophic infectious
2   illness in a patient comprising:
3   (a) continuously monitoring the patient's RR intervals;
4   (b) generating a normalized data set of the RR intervals;
5   (c) calculating one or more of (i) moments of the data set selected from the third and
6   higher moments and (ii) percentile values of the data set; and
7   (d) identifying an abnormal heart rate variability associated with the illness based on
8   one or more of the moments and the percentile values.

1   25. The method of claim 24, wherein the moments include the third moment of the
2   data set.

1   26. The method of claim 24, wherein the moments include the fourth moment of the
2   data set.

1   27. The method of claim 24, wherein the percentile values include the 10th
2   percentile value.

1   28. An apparatus for early detection of subacute, potentially catastrophic infectious
2   illness in a premature newborn infant comprising:

3 (a) a monitoring device, continuously monitoring heart rate variability in the

4 premature newborn infant; and

5 (b) a microprocessor, identifying at least one characteristic abnormality in the heart

6 rate variability that is associated with the illness.

1 29. The apparatus of claim 28, wherein the microprocessor performs the step of

2 generating a normalized data set of RR intervals.

1 30. The apparatus of claim 29, wherein the microprocessor calculates one or more

2 of the third and higher moments of the data set and identifies the characteristic

3 abnormality based on the one or more moments.

1 31. The apparatus of claim 30, wherein the microprocessor calculates the skewness

2 of the data set and identifies the characteristic abnormality based on the skewness.

1 32. The apparatus of claim 30, wherein the microprocessor calculates the kurtosis of

2 the data set and identifies the characteristic abnormality based on the kurtosis.

1 33. The apparatus of claim 29, wherein the microprocessor calculates one or more

2 percentile values of the data set and identifies the characteristic abnormality based

3 on the one or more percentile values.

1 34. The apparatus of claim 33, wherein the microprocessor calculates the 10th

2 percentile value of the data set and identifies the characteristic abnormality based on

3 the 10th percentile value.

1 35. An apparatus for early detection of subacute, potentially catastrophic infectious

2 illness in a patient comprising (1) a monitoring device, continuously monitoring the

3 patient's RR intervals, and (2) a microprocessor, said microprocessor performing

4 steps comprising:

5 (a) generating a normalized data set of the RR intervals;

6   (b) calculating one or more of (i) moments of the data set selected from the

7   third and higher moments and (ii) percentile values of the data set;

8   (c) identifying an abnormal heart rate variability based on one or more of

9   the moments and the percentile values.

1   36. The apparatus of claim 35, wherein the microprocessor calculates the third

2   moment of the data set.

1   37. The apparatus of claim 35, wherein the microprocessor calculates the fourth

2   moment of the data set.

1   38. The apparatus of claim 35, wherein the microprocessor calculates the 10th

2   percentile of the data set.